



# **Armed Forces College of Medicine AFCM**



# **The Motor Descending Tracts (I)**

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## ***INTENDED LEARNING OBJECTIVES (ILOs)***



By the end of this lecture the student will be able to:

1. Explain the physiological significances of the descending motor tracts.
2. Differentiate between medial and lateral descending brain stem pathways.
3. Describe physiological role of medial descending system in motor control.
4. Explain the mechanism of cortical control on axial and distal muscles.

# ***Control of motor function***



## **Higher centers**

- **Cortical motor areas (4, 6, 8)**
- **Basal ganglia.**
- **Cerebellum.**

## **Upper motor neurons**

- **UMN**

## **Lower motor neuron**

- **LMN**



## **Function:**

Control of skeletal muscle activity to produce:

**1- Muscle tone.**

**2- Movement :**

**a. Voluntary Movement:** purposeful movement correctly ordered in time and space.

**b. Reflex Action:** subconscious response due to stimulation of receptor.

# Somatic Motor System



## UMN (Upper motor neuron):

From level of the cortical motor areas down till  
-**Cranial motor nuclei** (Brain Stem)  
-**A.H.C.** (Spinal Cord).

It includes: 1. **Pyramidal tracts.**  
2. **Extra Pyramidal tracts.**

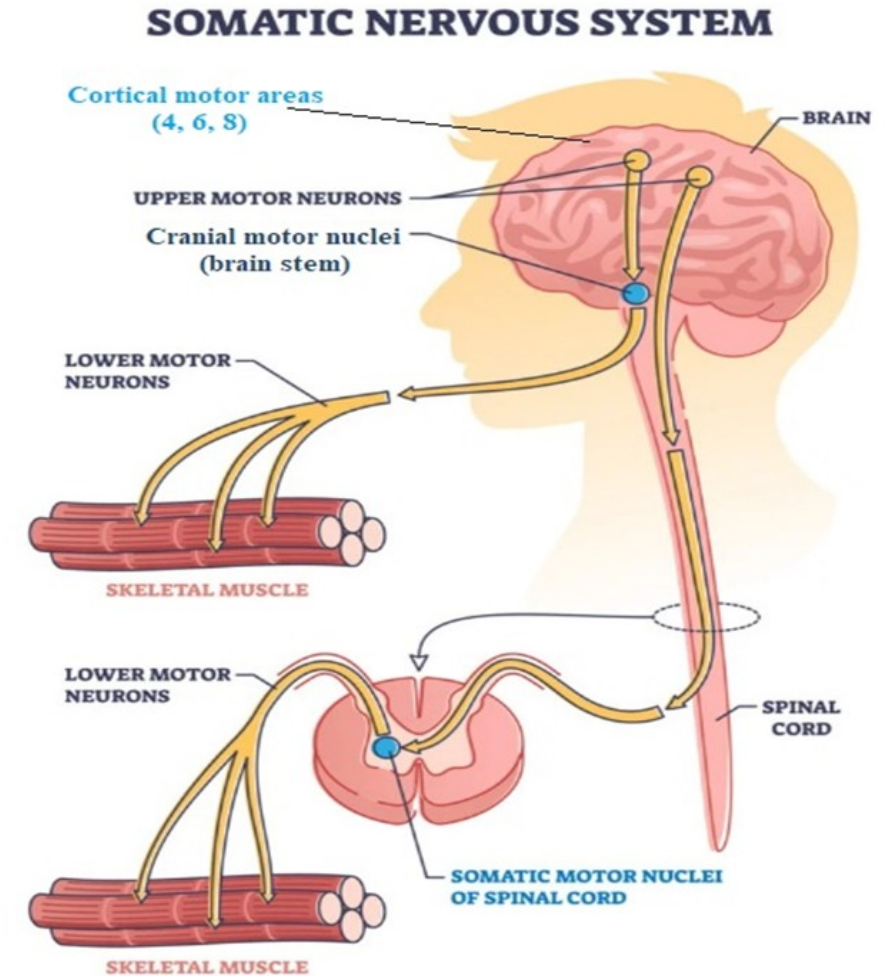
## LMN (Lower motor neuron):

It is the final common pathway for skeletal muscle activity .

-**A.H.C.** → it's axon (peripheral n.) → **Body** muscles on same side.

-**Cranial motor nuclei** → All cranial nerves (**except 1,2,8**) →

Head muscles on same



<https://www.simplypsychology.org/somatic-nervous-system.html>

# Descending Motor Tracts



## A. Pyramidal tracts:

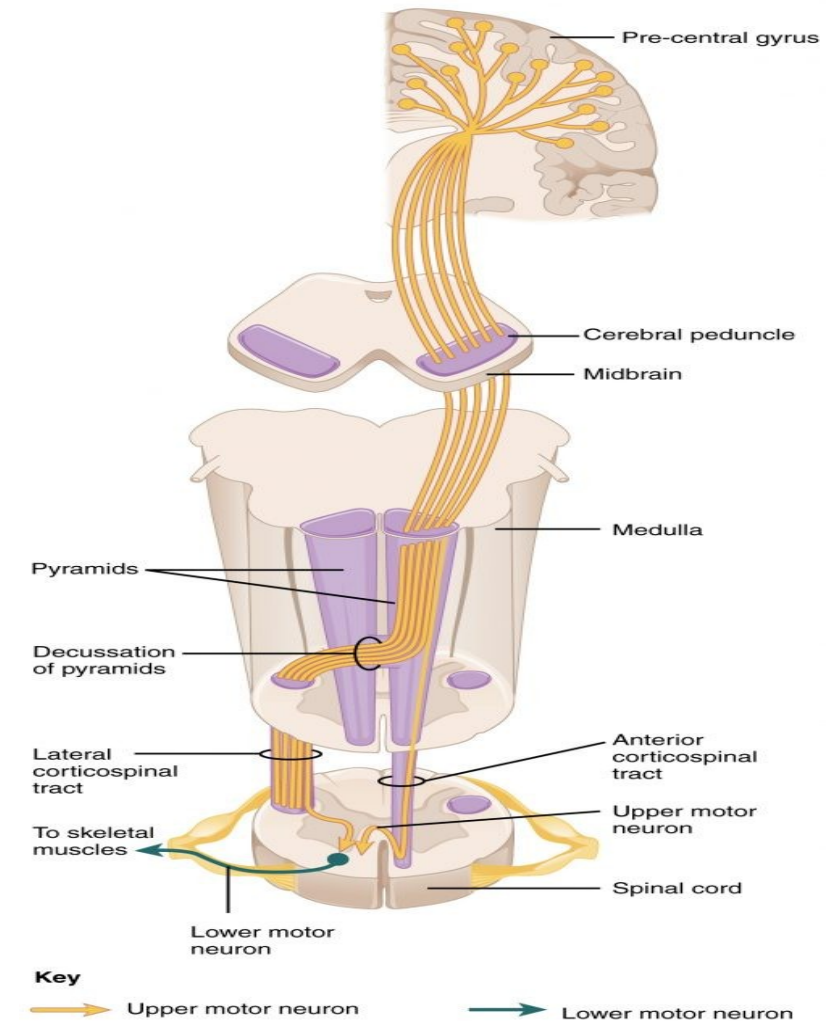
1. **Corticospinal** (→ **AHCs**. Of spinal cord).
2. **Corticobulbar** (→ CN. **V, VII, IX, X, XI & XII** of brain stem).
3. **Corticonuclear** (→ CN. **III, IV & VI** of brain stem).

## B. Extra pyramidal tracts:

4. **Rubrospinal**
5. **Vestibulospinal**
6. **Tectospinal**
7. **Reticulospinal**

According to their **position in spinal cord** they are divided into:

## A. Lateral motor system



<https://geekymedics.com/the-descending-tracts-of-the-central-nervous-system/>

# ***Descending Motor Tracts***



## ***Descending Motor Tracts***

### **Lateral Motor System**

**Lateral corticospinal**

**Rubrospinal**

### **Medial Motor System**

**Ventral corticospinal**

**Reticulospinal**

**Vestibulospinal**

**Tectospinal**



# ***Descending Motor Tracts***

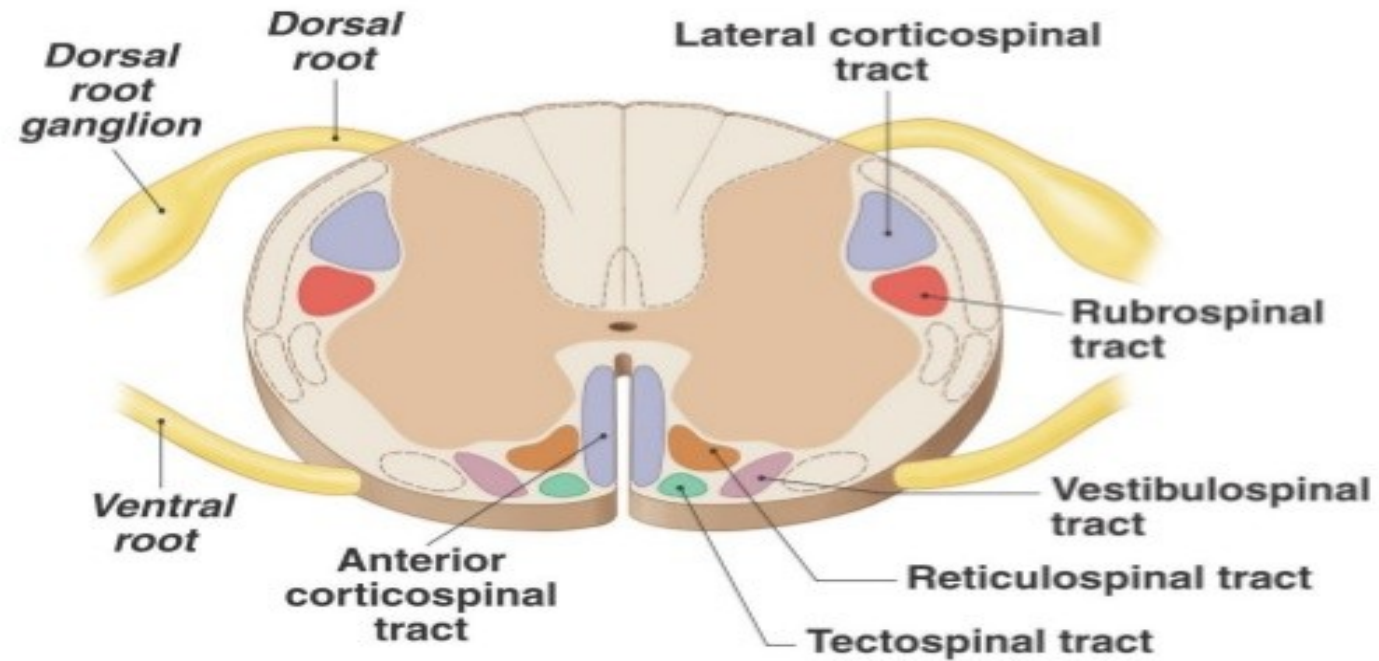


Figure 16.4b

(b) Cross-sectional view of descending motor tracts in the spinal cord

**Locations of major descending motor tracts that contain axons of upper motor neurons**

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## ***Descending Motor Tracts***



<b>Lateral Motor System</b>	<b>Medial Motor System</b>	
<b>Lateral</b> portion of <u>anterior horn</u>	<b>Medial</b> or ventral portion of <u>anterior horn</u>	<b>Site of termination</b>
<b>Distal limb</b> muscles	<b>Trunk</b> muscles <b>Proximal limb</b> muscles	<b>Muscles innervated</b>
Controls <b>fine, skilled</b> (discrete) voluntary movements	-Controls <b>gross movements</b> -Controls <b>body posture</b> -Provides <b>stable background</b> during performance of <u>fine movements</u> by distal limb muscles	<b>Function</b>
- <b>Lateral corticospinal</b> tract - <b>Rubrospinal</b> tract	- <b>Ventral corticospinal</b> tract - <b>Reticulospinal</b> tracts - <b>Vestibulospinal</b> tracts	<b>Tracts</b>

# ***Pyramidal System (Direct Activation Pathway)***



**1. Corticospinal tract:** Control LMNs of body muscles.

**2. Corticobulbar tract:**

Ends in brain stem, controls motor nuclei of cranial nerves supplying head muscles

(V, VII, IX, X, XI & XII) on the same and opposite sides, **except** the lower part of VII and XII motor nuclei (contralateral supply).

**3. Corticonuclear tract:**

Controls motor nuclei of cranial nerves supplying extra-ocular muscles of the eye (III, IV, VI).

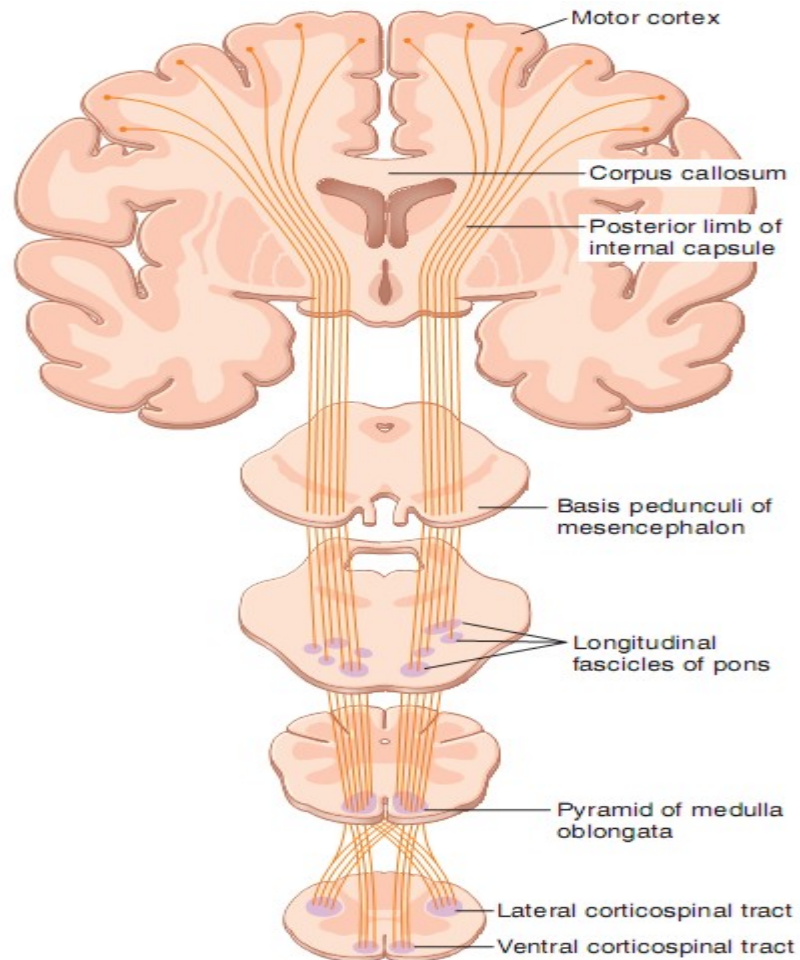
(N.B)

**-CST (Corticospinal tract)** : arises from cerebral cortex to reach A.H.C. **without relay.**

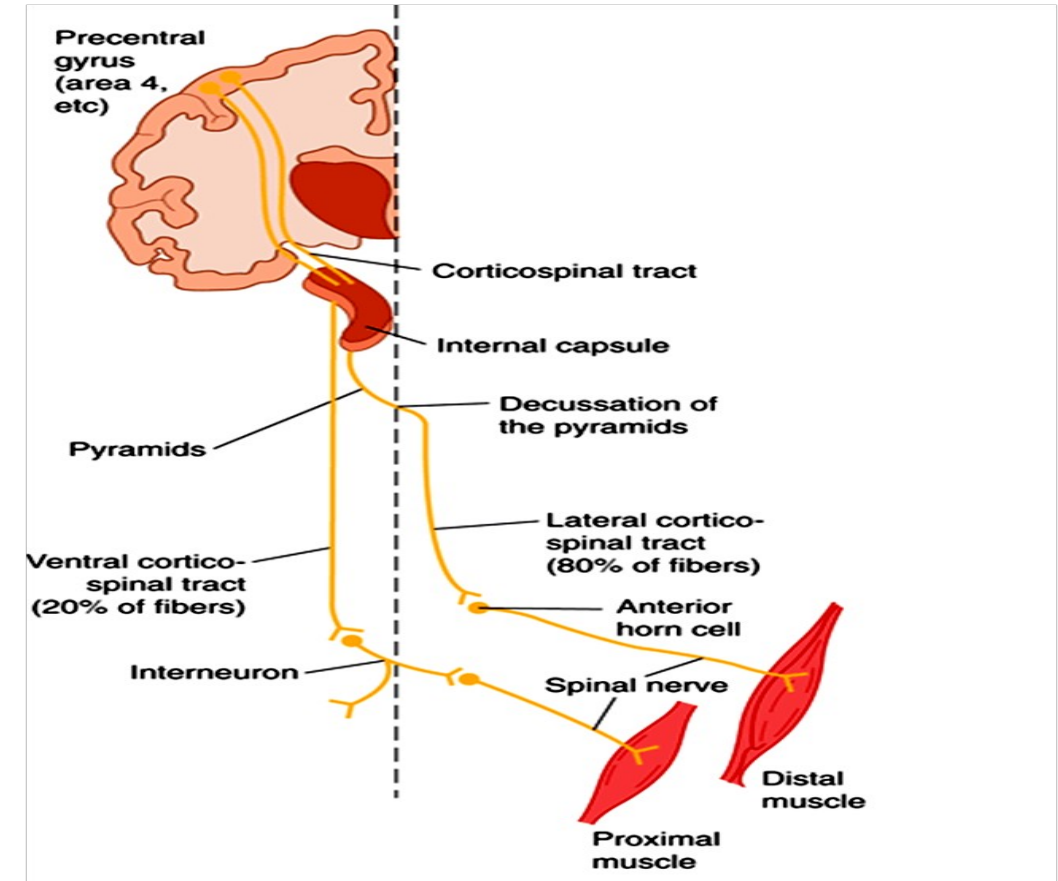
-Pure pyramidal Fibers (CST) are only in the pyramid of Medulla.

-Lesion of the pyramid of the medulla is fatal, so UMNL = Pyramidal + Extrapyramidal lesions.

# Corticospinal Tract



Guyton and Hall,  
2016



Ganong, 2016



## Functions of Pyramidal tract:

1. CBT controls **fine discrete** voluntary movement of **head muscles**.
2. CST for **body muscles**:  
**Lateral CST**: Primary pathway for initiation of **skilled voluntary movements**  
**Ventral CST**: **Postural adjustments**
3. Excitatory to **alpha motor neuron** → ↑ **muscle tone** and **tendon jerk**.

# ***Pyramidal System***



## **Lesions of Pyramidal tract:**

**Lateral CST lesion:** -**Loss** of fine movements of **fingers** and **hands**.

-**Intact** movements of **wrist**.

**Ventral CST lesion:** -Axial muscle deficits.

-Difficulty with balance, standing and walking.

**CBT lesion:** Paralysis of contralateral lower half of the face (Upper half is spared).

(In **LMNL**, ipsilateral upper & lower halves are affected)



# Pyramidal System



What is the type of the lesion?



**LMNL**

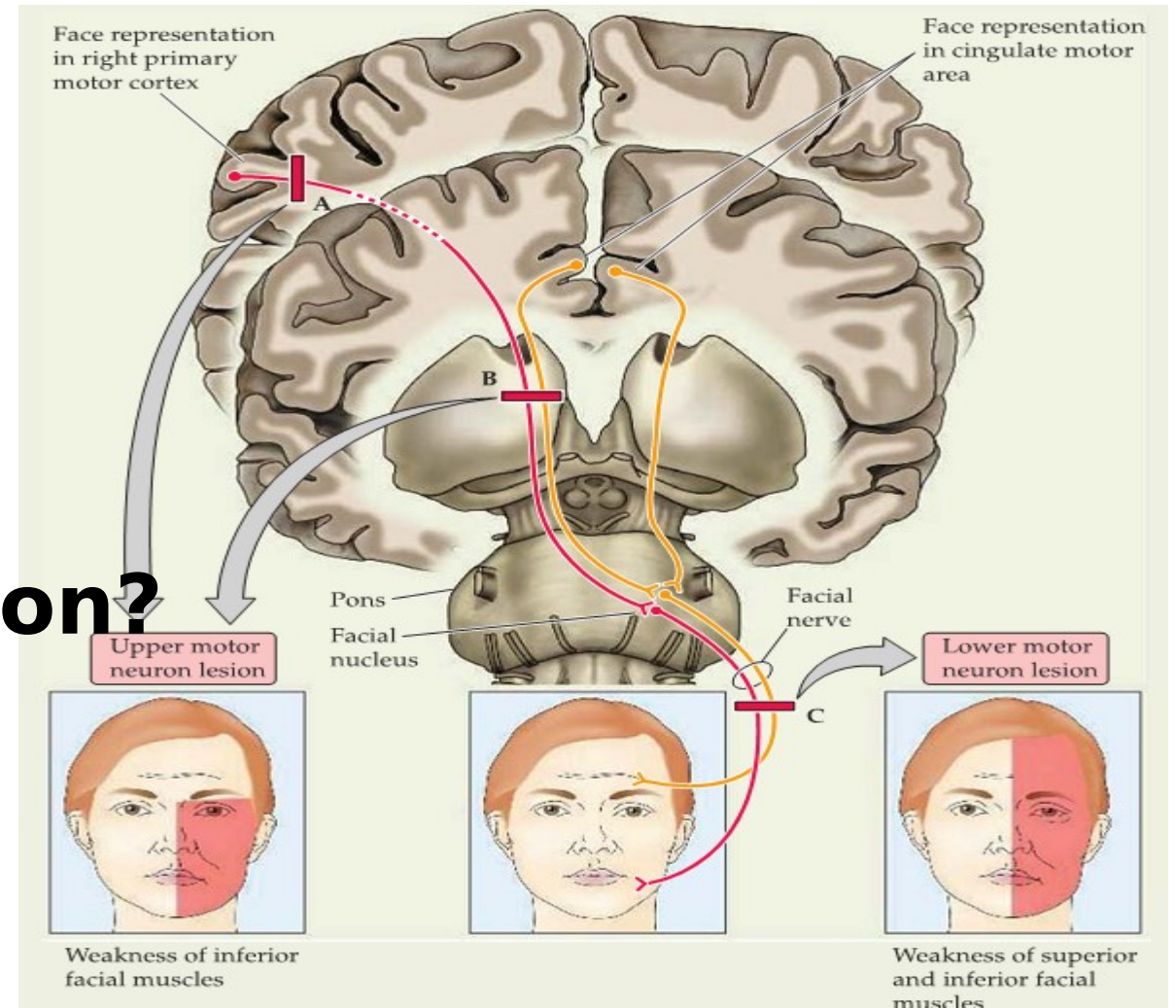
New Five Year Program



UMNL - CBT

**UMNL-  
CBT**

Neuroscience Module



**NEUROSCIENCE,  
2012**



### **1- Which of the following is true with respect to the lateral corticospinal pathway?**

- A. It must be intact to elicit a positive Babinski's sign.
- B. It synapses with gamma motor neurons in the spinal cord.
- C. It facilitate the stretch reflex.
- D. Is a multineuron pathway.
- E. Is responsible for gross movement.



# Summary



- Descending motor tracts include 2 systems: pyramidal tracts & extra pyramidal tracts.**
- Descending tracts also can be classified into lateral motor system & medial motor system.**
- Functions of pyramidal system include performance of fine discrete voluntary movement & postural adjustment.**
- Lesion of pyramidal system can cause loss of fine movements and difficulty with balance, standing & walking.**
- Functions of extra-pyramidal system include performance of gross movements of axial and proximal limb muscles.**

## ***SUGGESTED TEXTBOOKS***



1. Guyton and Hall textbook of medical physiology, thirteenth edition 2016, Elsevier, chapter 56 , from page 707 to 719
2. Ganong's Review of Medical Physiology, twenty-fifth edition 2016, McGraw-Hill Education, chapter 12, from page 227 to 254

***Thank You***